#### THE ECONOMICS OF SUPRANATIONAL BANK SUPERVISION



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## Motivation

- Experience of Global Financial Crisis has triggered rethink on bank resolution frameworks and cooperation between supervisors for cross-border banks
- Post-crisis increase in number of cooperation agreements and in intensity in cooperation (from information exchange and colleges of supervisors to resolution colleges and supranational supervisors)
- But still high variation in supervisory cooperation across regions and country pairs
- What drives this variation? Politics, economics?
- Consider benefits and costs of such cooperation?
- How effective is such cross-border supervisory cooperation?
- Consider effect on stability of cross-border banks

## This paper

- Collect data on the existence and intensity of cross-border supervisory cooperation agreements across 93 countries in Europe, Americas and Africa (plus Trans-Tasman) over period 1995 to 2013
- Explain likelihood of cooperation and intensity with a variety of variables that proxy for potential benefits of cooperation and potential costs
- Gauge whether cross-border supervisory cooperation is associated with higher stability of cross-border

## This paper

- Collect data on the existence and intensity of cross-border supervisory cooperation agreements across 93 countries in Europe, Americas and Africa (plus Trans-Tasman) over period 1995 to 2013
- 12% of country pairs have an agreement in place in 2013, sharp increase after the crisis
- Explain likelihood of cooperation and intensity with a variety of variables that proxy for potential benefits of cooperation and potential costs
- Benefits and costs can explain cooperation
- Gauge whether cross-border supervisory cooperation is associated with higher stability of cross-border
- Yes, it is, but only for "smaller" parent banks with a high share of foreign subsidiaries

### **Related literature**

- Design of financial safety net in a world with cross-border banking (Dell'Arriccia and Marquez, 2006, on capital adequacy; Acharya, 2003, on cooperating on all dimensions; Loranth and Morrison, 2007, how capital adequacy might reduce risktaking of cross-border banks) – so far, almost exclusively theory
- Incentives of national supervisors in a world with cross-border banking (Niepmann and Schmidt-Eisenlohr, 2013: national decisions on recapitalisation inefficient if international interbank market; Calzolari and Loranth, 2011: organization in branches vs. subsidiaries matters; Beck, Todorov and Wagner, 2013: biased intervention decisions of national supervisors in cross-border banks in 2008/9; Carletti, Dell'Arriccia and Marquez, 2016 on interaction of centralized supervisory decision-taking and local information collection; Calzolari, Colliard and Loranth, 2018, on coordination problem among national supervisors) - so far, almost exclusively theory
- Effects of regulation of cross-border banks (Aiyar et al., 2014a,b; Forbes et al. 2017 on credit; Ongena et al., 2013, on risk-taking – we look at effects of cross-border cooperation

### The broader picture

# External costs of bank failure – or why do we regulate banks

- Domino problem
- Network, interconnectedness
- Hostage problem
- Depositors panic
- Contagion through payment system
- Fridge problem
- Destruction of lending relationship, soft information
- How to overcome them?
- Efficient and swift resolution regime, using merger and acquisition, purchase and assumption, good bank-bad bank etc.

#### What if we move from national to cross-border level?



#### But face of cross-border banking has changed



## Let's talk a bit theory

### **Desirable Cross-Border Banking**

A "healthy" amount of cross-border banking is likely to be beneficial

- Diversification benefits for domestic banks and domestic borrowers
- Effect on efficiency and inclusion highly context-specific
- Critical role of foreign banks in transformation of banking systems in CEE
   3.0
- But: higher volatility of flows
- But: contagion costs



#### Why regulate cross-border banking?

- Failure of cross-border bank imposes costs on foreign stakeholders that are not taken into account by home country supervisor (Beck, Todorov and Wagner, 2013)
- Contagion effects through common asset exposures, fire sale externalities, informational contagion, interbank exposures etc.
- Does not depend on direct cross-border engagements by banks and on banklevel – not even on direct exposures to international markets
- More prominently as banks move towards market finance
- Regulatory arbitrage
- Within-in monetary union: additional externalities
- Close link between monetary and financial stability
- Lack of exchange rate tool exacerbates impact of asymmetric shock
- Common lender of last resort leads to tragedy of commons problem

#### Cross-border externalities are important, but one size does not fit all

- Countries differ in their legal systems (and culture). This makes it hard to specify a common set of rules and standards, forcing cumbersome adaptation of general principles to local circumstances.
- Differences in preferences. Countries may differ in how they view the role of the government in the economy (one consequence being differences in state ownership), focus on fiscal independence or with respect to their risk tolerance.
- Countries differ in their dependence on banks and their market structures in general. This influences the ease with which banks can be resolved and costs which bank failure impose on economy

#### A simple theoretical model (Beck and Wagner, 2016)

- 2 countries, i=A,B; one bank each
- No discount factor, interest rate zero, no equity; balance sheet normalized to 1
- Date 0: Bank invests in illiquid assets
- Date 2: assets mature, with prob.  $\lambda_i$  payoff is R>1, with prob. 1-  $\lambda_i$  payoff is zero and external costs  $c_i$
- **Date 1:** supervisor learns prob.  $\lambda_i$ ; bank can be liquidated with return 1
- Assume:  $c_A \le c_B$
- Share β of bank failure costs c fall on the other country



#### Efficient and decentralized solutions

- Date 1 payoff: 1
- Expected date 2 payoff:  $\lambda_i R (1-\lambda_i) c_i$
- Cutoff point:  $\lambda^* = [1+c_i]/[R+c_i]$
- Does not take into account externalities  $\beta$
- Date 1 payoff: 1
- Expected date 2 payoff:  $\lambda_i R (1-\lambda_i)(1-\beta)c_i$
- Cutoff point:  $\lambda^{D} = [1+(1-\beta)c_{i}]/[R+c_{i}(1-\beta)]$

#### Decentralized solution implies inefficiency

The higher cross-border externalities, the more lenient domestic supervisors under national supervision

#### But centralized solution is no silver bullet

- Supranational supervisor internalizes cross-border externalities
- BUT: takes average of failure costs; inefficiency

$$\lambda^S = \frac{1 + \frac{c_A + c_B}{2}}{R + \frac{c_A + c_B}{2}}.$$

The higher cross-border externalities, the more welfare improving a supranational supervisory authority.

The higher heterogeneity, the more welfare improving is staying with national supervisors



#### Back to current paper - Data

- Need data on cross-border supervisory cooperation, externalities and heterogeneity
- 93 countries and 4,278 country pairs during the period 1995-2013
- Limited to EU, Americas, Africa and AUS/NZL
- Hand-collected data on existence of cooperation agreements as well as intensity
- Memorandum of Understanding
- College of Supervisors
- MoU on crisis management and resolution
- Supra-national supervisor
- Data for heterogeneity and externality measures' calculations from different sources.

## Cooperation intensity across countries



#### **Cooperation over time**





Africa

# Measures of externalities (and thus benefits of cooperation)

- Foreign bank share (average across a country-pair) Claessens and van Horen (2014)
- Any G-SIBs present in both countries
- Stock market correlation when each market is in 5% lowest performance (Datastream, MSCI)
- Common currency or fixed exchange rate

#### Methodology: Externalities

We define:

$$E_{ij} = \frac{\sum_{v} \delta_{ijv} d_{ijv}}{\sum_{v} \delta_{ijv}}$$

• where  $\delta_{ijv}$  is an indicator equal to 1 whenever the observation is not missing for a given country-pair, and zero otherwise, and  $d_{ijv}$  ( $d_{ijv} \in [0, 1]$ ) equals

$$d_{ijv} = \frac{x_{ijv} - \min_k(x_{kv})}{\max_k(x_{kv}) - \min_k(x_{kv})}$$



## Measures of heterogeneity (and thus costs of cooperation)

- Political affinity (voting differences in UN General Assembly)
- Difference in foreign bank share
- Difference in legal origin
- Difference in GDP per capita
- Difference in latitude
- Difference in longitude
- Difference in language
- Difference in government debt/GDP

#### Methodology: Heterogeneity

- We calculate an aggregated heterogeneity measure using a set of variables at the country-pair level.
- The distance between country i and country j is defined as follows:

$$H_{ij} = rac{\sum_v \delta_{ijv} d_{ijv}}{\sum_v \delta_{ijv}}$$

■ where  $\prod_{ijv}$  is an indicator equal to 1 whenever both observations are not missing for both countries, and zero otherwise, and  $d_{ijv}$  ( $d_{ijv} \in (0, 1)$ ) is:

$$d_{ijv} = egin{cases} 0 & ext{if } x_{iv} = x_{jv} \ 1 & ext{if otherwise} \end{cases}$$

and for continuous variables v

$$d_{ijv} = \frac{|x_{iv} - x_{jv}|}{max_k(x_{kv}) - min_k(x_{kv})}$$

### Time variation in heterogeneity



### Methodology

$$P(cooperation_{ij}) = \alpha + \sum_{k=1}^{K} \beta_k E_{k,ij} + \sum_{l=1}^{L} \phi_l H_{l,ij} + \epsilon_{ij}$$

- Logit model
- Two-way clustering for each country of country-pairs

	Indices (1)	Components (2)	Fixed effects (3)	Principal components (4)	Conservative sample (5)	Bilateral agreements (6)	Trade (7)	Lagged indices (8)	Heckman 1st stage (9)	Heckman 2nd stage (10)	
Externality Heterogeneity	$\begin{array}{c} 0.485^{***} \\ (0.0617) \\ -0.427^{***} \\ (0.0624) \end{array}$	:	0.433*** (0.0458) -0.990*** (0.104)	:	$0.568^{***}$ (0.0621) -0.550^{***} (0.0723)	0.328*** (0.0498) -0.339*** (0.0618)	$\begin{array}{c} 0.266^{***} \\ (0.0409) \\ -0.282^{***} \\ (0.0547) \end{array}$			$\begin{array}{c} 0.566^{***} \\ (0.0332) \\ -0.746^{***} \\ (0.0405) \end{array}$	
Externanty <sub>PCA</sub>				0.0831*** (0.0185) -0.112***							
Externality <sub>2000</sub>				(0.0111)				0.488***			
${ m Heterogeneity}_{2000}$								(0.0575) -0.443*** (0.0583)	e in the second s		
Avg. foreign share	•	$2.132^{*}$						(0.0000)			
Correlation		$0.251^{***}$ (0.0590)									
Currency		$0.0812^{**}$ (0.0356)									
G-SIB		$0.114^{***}$ (0.0303)									
$\Delta Preferences$		-0.249** (0.119)									
$\Delta {\rm Foreign}$ share		$-0.438^{***}$ (0.156)									
$\Delta$ Legal origin		-0.00951 (0.0222)									
$\Delta$ Latitude		-0.298*** (0.109)									
$\Delta$ Longitude		$-0.415^{***}$ (0.106)									
$\Delta$ Language		$-0.0841^{**}$ (0.0422)									
$\Delta {\rm Debt}/{\rm GDP}$		(0.0393) (0.0759)									
$\Delta \text{GDP}$ per cap.		0.0926									
Trade		()					26.29*** (4.925)				
PTA							0.0988*** (0.0159)				
Internet use							(0.0100)		$\begin{array}{c} 0.004^{***} \\ (0.0004) \end{array}$		
Observations Pseudo- $R^2$ %-Predicted M-D test	$3,828 \\ 0.26 \\ 74.8 \\ 152.3$	$1,177 \\ 0.40 \\ 72.4 \\ 157.8$	$3,826 \\ 0.40 \\ 61.1 \\ 143.5$	$1,177 \\ 0.35 \\ 70.4 \\ 154.4$	$2,948 \\ 0.28 \\ 72.5 \\ 153.2$	$3,625 \\ 0.27 \\ 85.5 \\ 152.6$	$3,620 \\ 0.41 \\ 84.1 \\ 164.9$	$3,733 \\ 0.24 \\ 74.5 \\ 148.4$	3,828	3,828	

#### **Economic effects**

- One standard deviation in externality increases likelihood of cooperation by 9 percentage points
- One standard deviation in heterogeneity decreases likelihood of cooperation by 6 percentage points
- Sample mean: 12 percent

### Panel – how long until cooperation?

		(1)	(2)	(3)	(4)	
Е	$xternality_{t-1}$	3.622***	3.452***	2.746***	0.027***	
Н	$[eterogeneity_{t-1}]$	(0.179) -4.096***	(0.185) -4.284***	(0.212) -4.214***	(0.0051) - $0.062^{***}$	
	luicia	(0.348)	(0.357)	(0.363)	(0.0080)	
U	$11818_t$		(0.104)			
C	$common share_{t-1}$			$21.95^{***}$ (1.286)		
0	beorgentions	62 257	62 257	69 257	62 257	
0	oservations	03,237	03,237	03,237	03,237	

### Explaining the intensity of cooperation

	Model		Average marginal effects						
	estimates (1)	No cooperation (2)	MoU info. sharing	CoS	MoU crisis management	Supranational supervisor			
	(1)	(2)	(3)	(4)	(5)	(0)			
Externality	3.17***	-0.438***	0.104***	0.221***	0.073***	0.039***			
	(0.145)	(0.019)	(0.009)	(0.015)	(0.009)	(0.006)			
Heterogeneity	-2.822***	$0.389^{***}$	-0.093***	-0.196***	-0.065***	-0.035***			
	(0.205)	(0.029)	(0.010)	(0.014)	(0.009)	(0.007)			
Observations	3,762	3,762	3,762	3,762	3,762	3,762			
Pseudo- $R^2$	0.21	0.21	0.21	0.21	0.21	0.21			

## Summary of findings so far

- Higher externalities of cross-border banking and thus benefits of supervisory cooperation are associated with higher likelihood of cooperation and higher intensity
- Higher heterogeneity of countries and thus costs of supervisory cooperation are associated with lower likelihood of cooperation and lower intensity
- But is cross-border supervisory cooperation actually effective?

## Is cross-border supervisory cooperation effective?

- We cannot look at bank failures directly (not sufficient), so we would at changes in bank stability as cross-border supervisory cooperation changes
- Sample of 197 cross-border banks in 52 countries between 1995 to 2013
- Consider cooperation between home (parent bank) and host (subsidiaries) supervisors

## The effectiveness of supervisory cooperation

$$y_{b,j,t} = \beta_1 Cooperation_{b,t} + \beta_2 X_{b,t} + \beta_3 Z_{j,t} + \gamma_b + \delta_t + \epsilon_{b,j,t},$$

- b=bank, j, country, t=year
- Y = z-score, marginal expected shortfall
- Cooperation share of host supervisors with whom home supervisor has cooperation agreement (weighted by subsidiary's assets in total foreign assets)
- X = bank controls log of total assets, foreign to total assets, liabilities/assets, loan loss provisions/total loans, non-interest income to total income
- Z = country control log (GDP per capita), volatility of GDP growth, trade openness
- Bank and year fixed effects, standard errors clustered at bank-level

#### Effectiveness of cross-border supervisory cooperation Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Log(Z-Score)	3.752	1.647	-7.44	12.298	1105
Log(ROA+Equity/TA)	-2.595	0.741	-11.139	0.134	1618
Log(SD(ROA))	-6.311	1.703	-14.388	-1.755	1128
MES	0.038	0.026	-0.016	0.134	508
Cooperation	0.6	0.445	0	1	1661
Foreign TA/TA	0.16	0.237	0.005	0.942	1661
Log(assets)	10.364	1.975	2.333	12.358	1661
Liabilities/TA	0.906	0.12	0.069	0.992	1661
Loss prov./TL	0.014	0.021	-0.017	0.142	1540
Non-interest income/Income	0.299	0.208	-0.147	1	1177
Log(GDP per cap.)	9.822	1.167	5.48	11.322	1650
Vol(GDP growth)	0.093	0.061	0.004	0.566	1661
Trade/GDP	69.117	34.937	15.636	341.862	1657

#### Effectiveness of cross-border supervisory cooperation

		Log(Z-Score)	Log(Z-Score)	Log(Z-Score)	Log(Z-Score)
		(1)	(2)	Large (3)	(4)
Coo	peration	0.540**	0.541 **	0.184	1.187***
		(0.258)	(0.234)	(0.196)	(0.369)
Fore	ign TA/TA	-0.708	-1.003	0.251	-1.000
		(1.117)	(1.092)	(1.716)	(1.190)
Log(	assets)	$0.704^{***}$	$0.527^{**}$	$1.753^{**}$	0.431
		(0.268)	(0.253)	(0.688)	(0.350)
Liab	ilities/TA	-4.319*	-4.631**	-30.44***	-3.075
	-	(2.238)	(1.980)	(7.189)	(2.733)
Loss	prov./TL	-14.83**	-11.36**	-22.07***	-5.546
		(6.329)	(5.465)	(4.565)	(6.331)
Non	-interest income/Income	$2.298^{***}$	$2.127^{***}$	1.960 * * *	1.044
	-	(0.521)	(0.448)	(0.421)	(0.784)
Log(	(GDP per cap.)		8.811***	8.094***	$9.179^*$
			(1.524)	(1.448)	(4.956)
Vol(	GDP growth)		0.398	3.541	0.333
	_ ,		(1.248)	(2.945)	(1.642)
Trad	le/GDP		0.022**	-0.006	0.031**
			(0.0097)	(0.014)	(0.013)
Bard	L DD	v	v	v	v
Voar	FF	v	v	v	v
Obse	ervations	804	804	402	402
R-so	uared	0.21	0.28	0.47	0.21

One standard deviation in cooperation associated with 24% increase in distance from default

#### Effectiveness of cross-border supervisory cooperation Main results (2)

	Small banks							
	LLog(Z-Score) High FTA	Log(Z-Score) Low FTA	Log(ROA+Equity/TA)	$\mathrm{Log}(\mathrm{SD}(\mathrm{ROA}))$				
	(5)	(6)	(7)	(8)				
Cooperation	2.079***	0.695	0.028	-1.159***				
-	(0.627)	(0.595)	(0.084)	(0.341)				
Foreign TA/TA	-0.817	0.301	0.025	1.025				
	(1.232)	(13.57)	(0.172)	(1.103)				
Log(assets)	0.516	0.960	0.075	-0.356				
	(0.543)	(0.690)	(0.147)	(0.330)				
Liabilities/TA	3.424	-1.106	-6.946***	-3.872				
r (mr	(4.619)	(7.940)	(1.114)	(2.669)				
Loss prov./TL	-11.61	-3.292	-6.094**	-0.548				
NT 1	(9.104)	(7.042)	(2.419)	(5.434)				
Non-interest income/income	1.362	1.264	0.491	-0.554				
	(1.083)	(1.604)	(0.413)	(0.696)				
Log(GDP per cap.)	2.890	10.72	4.859	-4.319*				
V I(GDD	(3.705)	(8.120)	(3.779)	(2.258)				
Vol(GDP growth)	0.125	0.777	1.431	1.098				
The de (CIDD	(2.757)	(2.263)	(1.182)	(0.875)				
Irade/GDP	0.024	$0.036^{**}$	0.0059	-0.025**				
	(0.016)	(0.016)	(0.0051)	(0.012)				
Bank FE	V	v	N.	V				
Year FE	Y	Y	Ŷ	Y V				
Observations	901	901	¥ 409	100				
R-squared	201	0.91	402	402				
· ·	0.34	0.21	0.50	0.20				

#### Endogeneity concerns

- Supervisory cooperation arises from cross-border fragility
- Subsidiary structure arises from cooperation
- Instrument: cooperation propensity on country-pair level,
- based on UN General Assembly votes run duration model to predict cooperation propensity
- Use subsidiary structure at beginning of sample period to construct bank-specific instruments

$$S_{i,j,t} = 1 - \frac{\sum_{r=1}^{R} |V_r^i - V_r^j|}{R},$$

#### Effectiveness of cross-border supervisorv cooperation Robustness tests

	IV	IV			intensity
	1st stage	2nd stage			
	(1)	(2)	(3)	(4)	(5)
Cooperation IV	0.956**				
	(0.456)				
Cooperation		3.883*	-0.023***	0.894***	1.721***
		(1.998)	(0.007)	(0.330)	(0.586)
Cooperation*Crisis				0.625	
				(0.495)	
Cooperation <sup>2</sup>					2.493
					(1.535)
Foreign TA/TA	-0.209	1.069	-0.024	-1.005	-0.945
	(0.146)	(0.815)	(0.029)	(1.143)	(1.145)
Log(assets)	-0.024	0.392	-0.005	0.431	0.478
	(0.063)	(0.429)	(0.017)	(0.350)	(0.350)
Liabilities/TA	0.279	-1.933	-0.026	-3.169	-3.228
	(0.422)	(3.493)	(0.131)	(2.722)	(2.688)
Loss prov./TL	1.468	13.132**	0.013	-6.209	-4.746
	(1.216)	(5.670)	(0.123)	(6.097)	(6.403)
Non-interest income/Income	0.193	-1.363	0.035	1.056	1.129
	(0.157)	(0.966)	(0.021)	(0.786)	(0.794)
Log(GDP per cap.)	0.079	0.941	0.0076	9.433*	9.271*
	(0.598)	(3.203)	(0.086)	(4.923)	(4.977)
Vol(GDP growth)	0.186	-2.592**	-0.025	0.487	0.350
	(0.213)	(1.040)	(0.063)	(1.640)	(1.629)
Trade/GDP	-0.001	0.014	0.0005	0.031**	0.030**
	(0.003)	(0.020)	(0.0003)	(0.012)	(0.012)
Bank FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Observations	193	193	137	402	402
R-squared	0.35		0.62	0.22	0.22

#### Effectiveness of cross-border supervisory cooperation Interactions with supervisory variables

		Log(Z-Score)	Log(Z-Score)		
		(1)	(2)	(3)	
	Cooperation	2.436***	1.113**	0.876	
		(0.714)	(0.457)	(0.567)	
	Supervisory stringency $S$	-0.251***			
_		(0.0829)	-		
I	Cooperation*Supervisory stringency $_S$	0.274***			
I		(0.0812)			
1	Supervisory stringency $_{P}$	-0.0668	•		
		(0.129)			
ſ	Cooperation <sup>*</sup> Supervisory stringency <sub>P</sub>	0.775***	1		
L		(0.237)			
	External $audit_S$		-0.120		
			(0.695)		
	Cooperation <sup>*</sup> External $audit_S$		1.086		
			(1.051)		
	External $audit_P$		-0.720		
			(0.649)		
ſ	Cooperation <sup>*</sup> External audit <sub>P</sub>		2.431**		
I			(1.155)		
	Foreign entry <sub>S</sub>			0.824***	
				(0.178)	
Γ	Cooperation <sup>*</sup> Foreign entry <sub>S</sub>			0.783***	
L				(0.260)	
	Foreign entry $_P$			-0.0397	
				(0.353)	
	Cooperation <sup>*</sup> Foreign entry <sub>P</sub>			0.222	
				(0.615)	

## Conclusions

- Crisis has been a wake-up call for supervisory cooperation in cross-border cooperation
- Distortion in national supervision in financially integrated world becomes obvious in failure/resolution phase
- We can observe lots of variation in cross-border supervisory cooperation
- Cooperation varies with externalities and country heterogeneity, as predicted by theory
- Optimal degree of cooperation? No One Size Does Not Fit All!
- Cross-border cooperation can be effective, though mostly for "smaller" banks with high importance of foreign subsidiaries
- Important interaction with supervisory framework

## THANK YOU

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